

WHAT IS CLAIMED IS:

1. A downhole acoustic tool apparatus comprising:
an acoustic source;
an acoustic receiver section; the acoustic receiver section comprising:
a central mandrel; and
an outer sleeve having alternating zones of high and low acoustic impedance,
the high and low acoustic impedance differing by at least a factor of two.
2. The tool of claim 1, further comprising one or more acoustic receivers attached to the mandrel and housed by the outer sleeve.
3. The tool of claim 1, further comprising oil disposed in an annulus between the central mandrel and the outer sleeve, the oil comprising an acoustic impedance matched to borehole fluid.
4. The tool of claim 3, wherein the oil is pressurized to match a borehole environment.
5. The tool of claim 1, wherein the alternating zones comprise bands having different acoustic impedance.
6. The tool of claim 5, wherein the bands comprise separate, circumferentially continuous bands.
7. The tool of claim 1, wherein the alternating zones comprise a plurality of circumferentially continuous, axially discontinuous bands.

8. The tool of claim 1, wherein the high and low acoustic impedance differs by at least a factor of 5.

9. The tool of claim 1, wherein the high and low acoustic impedance differs by at least a factor of 10.

10. The tool of claim 2, wherein each low acoustic impedance zone is aligned axially with one or more of the acoustic receivers.

11. The tool of claim 1, wherein each low acoustic impedance zone comprises an acoustic impedance substantially matching borehole fluid.

12. The tool of claim 1, wherein an outer surface of the outer sleeve is acoustically smooth.

13. The tool of claim 1, wherein the mandrel is hollow and defines a wiring conduit.

14. The tool of claim 1, further comprising a plurality of mass blocks attached about the mandrel, wherein the one or more acoustic receivers are attached to the mass blocks.

15. The tool of claim 1, wherein the mass blocks comprise an inner diameter bearing against an outer diameter of the mandrel in an interference fit.

16. The tool of claim 1, wherein the outer sleeve comprises a multiple modules, each module including:

a first hollow metallic cylinder,

a first supporting ring coaxial with and attached to the first hollow metallic cylinder;

a second supporting ring coaxial with and spaced axially from the first support ring;

and

a second hollow cylinder comprising elastomer, resin, or both elastomer and resin disposed between the first and second supporting rings.

17. The tool of claim 16, wherein the outer sleeve comprises a resin pipe with at least two metal rings attached thereto, the at least two metal rings being spaced from one another.

18. The tool of claim 17, wherein the at least two metal rings are disposed in mating recesses along an internal surface of the resin pipe.

19. The tool of claim 17, wherein the at least two metal rings are adhered to and protrude from an internal surface of the resin pipe.

20. The tool of claim 16, wherein the outer sleeve comprises an elastomeric pipe with at least two metal rings attached thereto, the at least two metal rings being spaced from one another.

21. The tool of claim 16, wherein the first and second cylinders are separable for maintenance and repair.

22. A sonic receiver sonde comprising:

a mandrel;

a plurality of spaced mass blocks attached to the mandrel;

a plurality of sonic receivers disposed in at least one of the plurality of spaced mass blocks; and

an outer sleeve covering the plurality of spaced mass blocks and sonic receivers, the outer sleeve comprising first and second zones, the first zone comprising an acoustic impedance at least twice as high as the second zone.

23. The sonic receiver sonde of claim 22, wherein the first zone comprises an acoustic impedance at least five times as high as the second zone.
24. The sonic receiver sonde of claim 22, wherein the first zone comprises an acoustic impedance at least ten times as high as the second zone.
25. The sonic receiver sonde of claim 22, wherein the second zone is substantially acoustically transparent.
26. The sonic receiver sonde of claim 22, wherein the second zone is axially aligned with the plurality of sonic receivers.
27. The sonic receiver sonde of claim 22, further comprising a plurality of alternating first and second zones.
28. The sonic receiver sonde of claim 27, wherein the plurality of sonic receivers is disposed in at least two of the spaced mass blocks, and wherein each of the plurality of sonic receivers is axially aligned with one of the second zones.
29. The sonic receiver sonde of claim 22 wherein the first and second zones comprise alternating circumferentially continuous bands.
30. The sonic receiver sonde of claim 29, wherein the first zone comprises a metal band and the second zone comprises an elastomeric band.
31. The sonic receiver sonde of claim 30, wherein the metal and elastomeric bands are separable for maintenance and replacement.

32. The sonic receiver sonde of claim 28, wherein the first zone comprises a steel band and the second zone comprises a plastic band.
33. The sonic receiver sonde of claim 30, wherein an outer surface of the outer sleeve is acoustically smooth relative to a wavelength of sonic signals received by the sonic receivers.
34. The sonic receiver sonde of claim 22, wherein the outer sleeve comprises a plurality of sleeve modules.
35. The sonic receiver sonde of claim 34, wherein each of the sleeve modules comprises:
 - a first hollow metallic cylinder;
 - a second hollow cylinder comprising elastomer, resin, or both elastomer and resin;and
 - first and second supporting rings.
36. The sonic receiver sonde of claim 22, wherein the outer sleeve comprises a resin pipe with at least two metal rings attached thereto, the at least two metal rings being spaced from one another.
37. A sonic receiver sleeve comprising:
 - a first hollow metallic cylinder,
 - a first supporting ring coaxial with and attached to the first hollow metallic cylinder;
 - a second supporting ring coaxial with and spaced axially from the first support ring;and
 - a second hollow cylinder comprising elastomer, resin, or both elastomer and resin disposed between the first and second supporting rings.
38. The sonic receiver sleeve of claim 37, further comprising:

a third hollow metallic cylinder attached to the second supporting ring opposite of the second hollow cylinder;

a third supporting ring coaxial with and attached to the third hollow metallic cylinder;

a fourth supporting ring coaxial with and spaced axially from the third support ring; and

a fourth hollow cylinder comprising elastomer, resin, or both elastomer and resin disposed between the first and second supporting rings.

39. The sonic receiver sleeve of claim 38, wherein the second and fourth hollow cylinders are aligned with sonic receivers of a sonic logging tool.

40. The sonic receiver sleeve of claim 38, wherein the first and third hollow metallic cylinders each comprise an acoustic impedance at least twice as high as the second and fourth hollow cylinders.

41. The sonic receiver sleeve of claim 38, wherein the first and third hollow metallic cylinders each comprise an acoustic impedance at least ten times as high as the second and fourth hollow cylinders.

42. An acoustic receiver sonde comprising:

a central rigid mandrel;

a plurality of spaced receiver blocks rigidly attached to the mandrel;

a plurality of acoustic receivers attached to each of the plurality of spaced receiver blocks; and

a plurality of axially discontinuous, circumferentially continuous acoustic impedance zones covering the plurality of spaced receiver blocks and acoustic receivers.

43. The acoustic receiver sonde of claim 42, wherein alternating zones differ in acoustic impedance by at least a factor of two.

44. The acoustic receiver sonde of claim 42, wherein alternating zones differ in acoustic impedance by at least a factor of five.
45. The acoustic receiver sonde of claim 42, wherein alternating zones comprise steel and elastomeric rings.
46. The acoustic receiver sonde of claim 42, wherein alternating zones comprise steel and resin rings.